Chapter 7
Eye Tracking Applications for E-Learning Purposes: An Overview and Perspectives

Ismail El Haddioui
https://orcid.org/0000-0002-9865-4410
Hassan II University, Morocco

ABSTRACT

E-learning has become a fundamental part of child education, higher education, and corporate training. In the design of adaptive e-learning environments, it is important to track and analyze learner behavior and preferences, and this is possible by recording their eye movements. Eye tracking is a technology developed to monitor eye movements allowing us to analyze the recorded gaze data. The main goal of this chapter is to determine the potential of eye tracking in the field of e-learning and the various applications of eye movement analysis for e-learning platforms. Results can be used to design an adaptive e-learning environment able to collect, analyze, and understand learner online behavior, preferences, and needs, and then offer an educational content adapted to each learner’s needs by generating new customized learning situations.

INTRODUCTION

The main purpose of e-learning systems is to develop and maintain successful learning processes, and it’s more complicated than the ordinary situation of a teacher in a classroom, because there is no human visual interaction. In addition, learners—especially children who are more enthusiastic and talkative than adults—can lose
concentration and motivation easily if the platform is not tailored to their needs. In a virtual learning environment, educators need to take into account all learners’ individual differences that teachers spontaneously use in a classic classroom to improve the learning situation, like behavior, motivation, cognitive development, learning style and level of attention.

Eye tracking technology has progressed fast in the few last years, especially in virtual reality, advertising, gaming and market research industry. The acquisition of eye tracking companies like OculusVR, EyeFluence, GazeHawk and EyeTribe by Google and Facebook, and also the collaboration between Tobii and Microsoft to bring eye-tracking support in Windows 10 are prelude to the new human-computer interaction paradigm that rely on future technological advances, which aim to transform interface devices into embeddable and wearable objects. In education industry, eye tracking technology can be used to study perceptual, cognitive, and social emotional development for children, and also to improve the learning process on adaptive e-learning environments.

BACKGROUND

Eye Tracking Techniques

Many different techniques have been used to track eye movements since the use of eye tracking was first pioneered in reading research over 100 years ago (Poole & Ball, 2005):

- **Electro-Oculographic Method (EOG):** The EOG is an old method established by Fenn & Hursh in 1934 to measure differences in electric potential induced by eye rotation. These electrical potentials are captured by five electrodes placed around the eye (Baccino & Colombi, 2000).

- **Scleral Search Coils Method:** Embedded into a contact lens that covered the cornea (the clear membrane covering the front of the eye) and the sclera (the white of the eye that is seen from the outside) (Poole & Ball, 2005).

- **Photo-OculoGraphy (POG) or Video-OculoGraphy (VOG):** This category groups together a wide variety of eye movement recording techniques involving the measurement of distinguishable features of the eyes under rotation or translation, e.g., the apparent shape of the pupil, the position of the limbus (the iris-sclera boundary), and corneal reflections of a closely situated directed light source (often infra-red) (Duchowski, 2003).
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